Clinical Applications of MTA in Endodontics

The development of Mineral Trioxide Aggregate (MTA) material by Torabinejad in 1993, was truly a landmark event in dentistry and in endodontics in particular. This event dramatically increased the success rate of many cases that used to have high failure rates. The many advantages of MTA material enlarged its use markedly in different fields of dentistry, from which, endodontics was the largest field to take advantage of this material.

What is MTA?
MTA is a powder consisting of fine hydrophilic particles of tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide. It also contains small amounts of other mineral oxides, which modify its chemical and physical properties. Hydration of the powder results in formation of colloidal gel with a pH value equal to 12.5 that solidifies to form a strong impermeable hard solid barrier in approximately three to four hours. Bismuth oxide powder has been added to make the aggregate radio-opaque.

MTA has a pH of 12.5 after setting, similar to calcium hydroxide. This may impart some antimicrobial properties. The material has a low solubility and a radio-opacity slightly greater than that of dentin. Because it has low compressive strength, it should not be placed in functional areas.

MTA has shown potential as an endodontic material in several in vitro and in vivo studies. It was first recommended as a material for repair of root perforations. It was then widely used as a root-end filling material and for vital pulp therapy, including direct pulp capping and pulpotomy of immature teeth with vital pulps. In addition, because of its sealing ability, it was also suggested as an apical barrier in the treatment of teeth with opened apices and necrotic pulps. Masuda et al. in 2005, examined MTA in vivo and concluded that MTA is biocompatible and does not produce any adverse effects on microcirculation in the connective tissue. Witherspoon et al. in 2006, stated that MTA may be useful as a substitute for calcium hydroxide in pulpotomy procedures.

Advantages of MTA
- High biocompatibility
- Hydrophilic
- Radio-opaque
- Highly alkaline pH (Bacteriostatic)
- Excellent sealing ability (Low marginal leakage)
- Low solubility

Disadvantages of MTA
- Difficult manipulation
- High cost
- Irreversible application

What’s so Unique About MTA?
Materials used to repair perforations, seal the retro-preparation in surgical endodontics, close open apices or to protect the pulp in direct pulp capping, are inevitably in contact with blood and other
revealed normal physiological formation of the apices (Fig. 2b).

2) An Apexification Case: An eleven-year-old boy attended the clinic complaining of pain in his upper central tooth. Radiographic examination revealed the presence of a periapical lesion surrounding an opened apex of an upper central incisor tooth (Fig. 3a). MTA was used in an orthograde mode to seal the apex. An x-ray taken 12 months later revealed almost complete healing of the lesion (Fig. 3b).

3) A Perforation Case: A 24 year old lady attended the clinic with pain and tenderness affecting her lower molar tooth. Radiographic examination revealed the presence of a lateral perforation caused by improper post placement (Fig. 4a). MTA was used to seal the perforation. A radiograph taken 6 months later revealed favorable healing (Fig. 4b).

Conclusion
The use of MTA changed dramatically the treatment plan and increased the success rate of many previously thought of as hopeless cases. MTA is an efficient and promising dental tissue fluids. This moisturizing effect may be an important factor that has major effects on the physical properties and sealing abilities of the restorative materials. MTA is however not affected by moisture or blood contamination. The presence or absence of blood seems not to affect the sealing ability of the mineral trioxide aggregate.

Clinical Cases
1) An Apexogenesis Case: A twelve-year-old girl attended the clinic with acute pulpitis affecting her lower 2nd molar. A radiograph showed that the molar’s roots were not fully formed (Fig. 2a). MTA was used as a direct pulp capping material after removal of the inflamed coronal pulp. An x-ray taken six months later.
material that should be used routinely in the practice of endodontics.

References